109th CONGRESS 1st SESSION

HOUSE OF REPRESENTATIVES

Under clause 8 of Rule XII, executive communications were taken from the Speaker's table as follows:
COMMUNICATION 02024 from the

Under Secretary for Acquisition, Technology and Logistics, Department of Defense

transmitting

a report describing the Department's corrosion prevention control and mitigation efforts and planned improvements, as requested by the House of Representatives Report of the Committee on Appropriations on the Department of Defense Appropriations Bill for FY 2005, Pub. L. 108-553 (H.R. 4613).

Referred to the Committee on Armed Services. May 19, 2005.

THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-3010

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

MAY 6 2005

The Honorable J. Dennis Hastert
Speaker of the House of Representatives
Washington, DC 20515

Dear Mr. Speaker:

I have enclosed the report that describes the Department's corrosion prevention control and mitigation efforts and planned improvements. The House of Representatives Report of the Committee on Appropriations on the Department of Defense Appropriations Bill for Fiscal Year 2005, 108-553 (H.R. 4613) requested a report to be provided to the congressional defense committees describing the Department's corrosion prevention control and mitigation status and planned improvements. Also, the Government Accountability Office in GAO-04-640, Defense Management: Opportunities Exist to Improve Implementation of DoD's Long-Term Corrosion Strategy, June 2004, requested that the Department provide the defense congressional committees a status update regarding the Department's corrosion prevention and mitigation efforts.

Similar letters have been sent to the President of the Senate and the appropriate congressional defense committees.

Sincerely,

Michael W. Wynne

Enclosure:
As stated

Office of the Secretary of Defense

REPORT TO CONGRESS

Department of Defense

Status Update on Efforts to Reduce Corrosion and the Effects of Corrosion on the Military Equipment and Infrastructure of the Department of Defense

May 2005

Prepared by the
Principal Deputy Under Secretary of Defense
(Acquisition, Technology and Logistics)

Office of the Secretary of Defense

REPORT TO CONGRESS

Department of Defense

Status Update on Efforts to Reduce Corrosion and the Effects of Corrosion on the Military Equipment and Infrastructure of the Department of Defense

May 2005

Prepared by the
Under Secretary of Defense
(Acquisition, Technology and Logistics)

Status Update on Efforts to Reduce Corrosion and the Effects of Corrosion on the Military Equipment and Infrastructure of the Department of Defense

Report to Congress

The Department of Defense is pleased to submit this Report to Congress, outlining our ongoing efforts to reduce corrosion and the effects of corrosion on the Department's military equipment and infrastructure. This report is submitted in response to guidance in House Report 108-553, 2005 DoD Appropriations Bill and the recommendation in Government Accountability Office (GAO) audit GAO-04-640. The GAO audit recommended the Department submit a report to Congress identifying the

- long-term funding and personnel resources needed to implement the corrosion strategy,
- status of the corrosion reduction projects funded in fiscal year 2005, and
- status of the cost of corrosion baseline study.[1, 2]

In addition, this report updates other key corrosion activities, including the

- transition of corrosion control and oversight activities from task force status to embedding the responsibilities within the Office of the Secretary of Defense (OSD),
- identification and characterization of corrosion-related specifications and standards,
- enhancements in corrosion training for appropriate DoD personnel, and
- activity highlights of the seven working integrated product teams (WIPTs): Communication and Outreach; Facilities/Infrastructure; Impact, Metrics and Sustainment; Policy and Requirements; Science and Technology; Specifications/Standards and Product Qualification; and Training and Doctrine.

This report updates information contained in the initial Report to Congress, *Long-term Strategy to Reduce Corrosion and the Effects of Corrosion on the Military Equipment and Infrastructure of the Department of Defense*, December 2003, and the Department's *Strategic Plan for Corrosion Prevention and Mitigation*, November 2004. Both documents are available on the DoD Corrosion Exchange website (http://www.dodcorrosionexchange.org). Readers of this report are encouraged to review these documents for additional corrosion program information, including background, vision, mission, management concept, congressional direction (10 USC 2228), and strategic milestones.

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[1] Government Accountability Office GAO-04-640, Defense Management, *Opportunities Exist to Improve Implementation of DoD's Long-Term Corrosion Strategy*, June 2004, p. 14.

[2] Compliance matrices for House Report 108-553 and GAO audit 04-640 are contained in Appendix B.

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Section I
Background and Program Status

It is simply good sense and good management to prevent corrosion through better design and selection of materials, and to reduce treatment costs by detecting corrosion earlier and more precisely. Fighting corrosion is just one of the things that we need to constantly do so that we are always ready to perform the fundamental mission of the Department, which is to maintain our national security.[1]

—Honorable Michael W. Wynne, DoD Corrosion Executive

Tremendous effort continues in support of the Department's objective of mitigating the safety, readiness, and financial effects of corrosion. Recent specific accomplishments include

- funding and initiation of 26 specific corrosion-related projects,
- initiation of the cost-of-corrosion study project to examine the costs related to Army ground vehicles and Navy ships/submarines during FY2005,
- transition of corrosion control and oversight activities from task force status to embedding the responsibilities within the Office of the Under Secretary of Defense Acquisition, Technology and Logistics (OUSD[AT&L]),
- initiation of the development of the Corrosion 101 course—targeted to the Department's acquisition workforce—by NACE International,
- institutionalization of corrosion prevention and mitigation as a key component of the Department's transformation process through the Planning, Programming, Budgeting, and Execution (PPBE) system, and
- continued refinement of the corrosion project "road map" that identifies specific actions that would prevent or mitigate corrosion.

Despite these and other actions, additional measures must be planned, resourced, scheduled, and accomplished in order to expand corrosion prevention and mitigation efforts. These measures are detailed in the Strategic Plan.

Background

The Department of Defense acquires, operates, and maintains a vast array of physical assets, ranging from aircraft, ships, ground combat vehicles, and other materiel to wharves, buildings, and other infrastructure. These assets are subject to degradation due to corrosion, with specific effects in the following areas:

- Safety—Several weapon system mishaps have been attributed to the effects of corrosion.

[1] *The AMPTIAC Quarterly*, Volume 7, Number 4, Winter 2003, p. 9.

- Readiness—Military assets are sometimes out of commission due to corrosion deficiencies.
- Cost—The cost of corrosion to the DoD is estimated to be between $10 billion and $20 billion annually.[2]

DoD has a long history associated with corrosion prevention and control. The Department has been a leader in many areas of research (ranging from understanding the fundamentals of corrosion to applying advanced materials, coatings, inhibitors, and cathodic protection for corrosion control); however, it also has very special corrosion-related challenges.

- DoD's infrastructure is getting older in both relative and absolute terms. The current expected—although often not planned—service lives of some aircraft, missiles, ships, and infrastructure are much longer than any comparable commercial assets.
- In order to perform its mission, the Department must train and fight in all environments, some of which are among the most corrosively aggressive on earth.
- DoD has unique corrosion-related issues. For example, many equipment coatings are primarily formulated to perform some special function, such as resisting chemical agents or maintaining low signature. Corrosion is at best a secondary consideration.
- Like several other DoD efforts, many corrosion activities have been decentralized, which may have decreased their desired visibility and emphasis.
- The Services' existing financial and logistics information systems cannot precisely identify all corrosion-related programs, costs, and impacts.

To enhance DoD's efforts, section 1067 of the Bob Stump National Defense Authorization Act for Fiscal Year 2003, Public Law 107-314 (NDAA), enacted 10 U.S.C. 2228. Section 2228 requires the Secretary of Defense to designate an official or organization to be responsible for the prevention and mitigation of corrosion of military equipment and infrastructure. It also requires the development and implementation of a long-term strategy. As stated, the long-term strategy was published in November 2004 and is accessible on htttp://www.dodcorrosionexchange.org. In addition, the long-term strategy will be updated annually so that it remains current and relevant.

The Government Accountability Office conducted two recent corrosion related audits:

- GAO-04-640, *Opportunities Exist to Improve Implementation of DoD's Long-Term Corrosion Strategy*, June 2004, acknowledged ongoing DoD efforts but identified areas that require increased emphasis.
- GAO-03-753, *Opportunities to Reduce Corrosion Costs and Increase Readiness*, July 2003, recommended the DoD corrosion strategic plan (then in development) address a number of issues, including performance measures, standard project evaluation criteria, and inter-service coordination of projects.

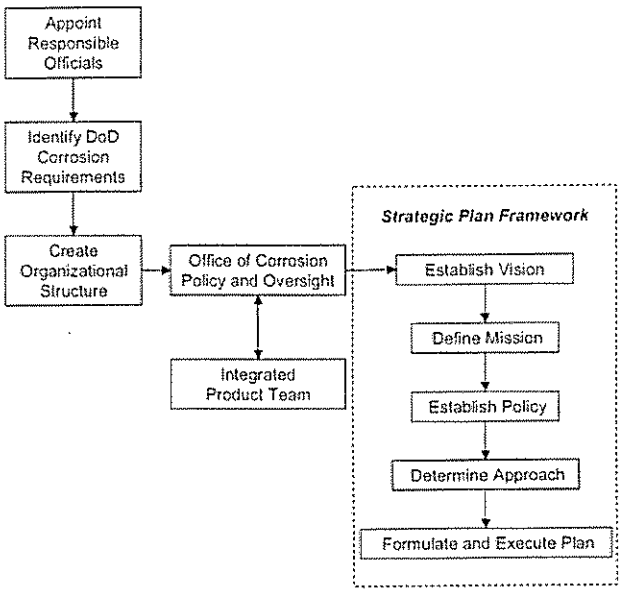
[2] United States General Accounting Office, *Opportunities to Reduce Corrosion Costs and Increase Readiness*, GAO-03-753, July 2003, p. 3.

In addition, the GAO has recently started two corrosion-related reviews—*DoD's Corrosion Strategy* and *Corrosion of Prepositioned Assets.*

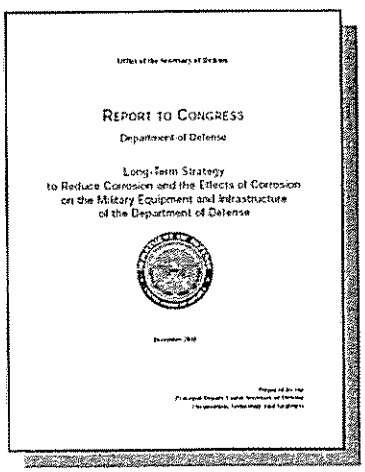
Long-Term Corrosion Strategy

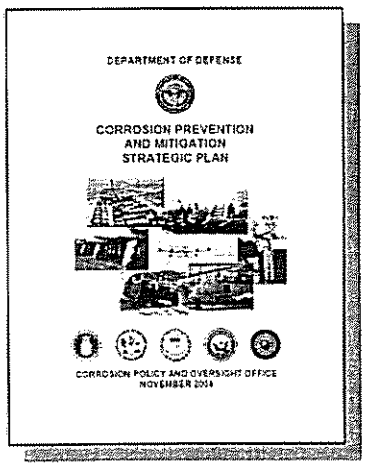
Figure I-1 depicts the approach DoD used in developing its long-term strategy.

Figure I-1. DoD Corrosion Prevention and Mitigation Strategy



The activities depicted above are discussed in detail in the December 2003 report to Congress.[3] As a result of this effort, the *Strategic Plan for Corrosion Prevention and Mitigation* was developed and published in November 2004. Both reports are accessible at http://www.dodcorrosionexchange.org.





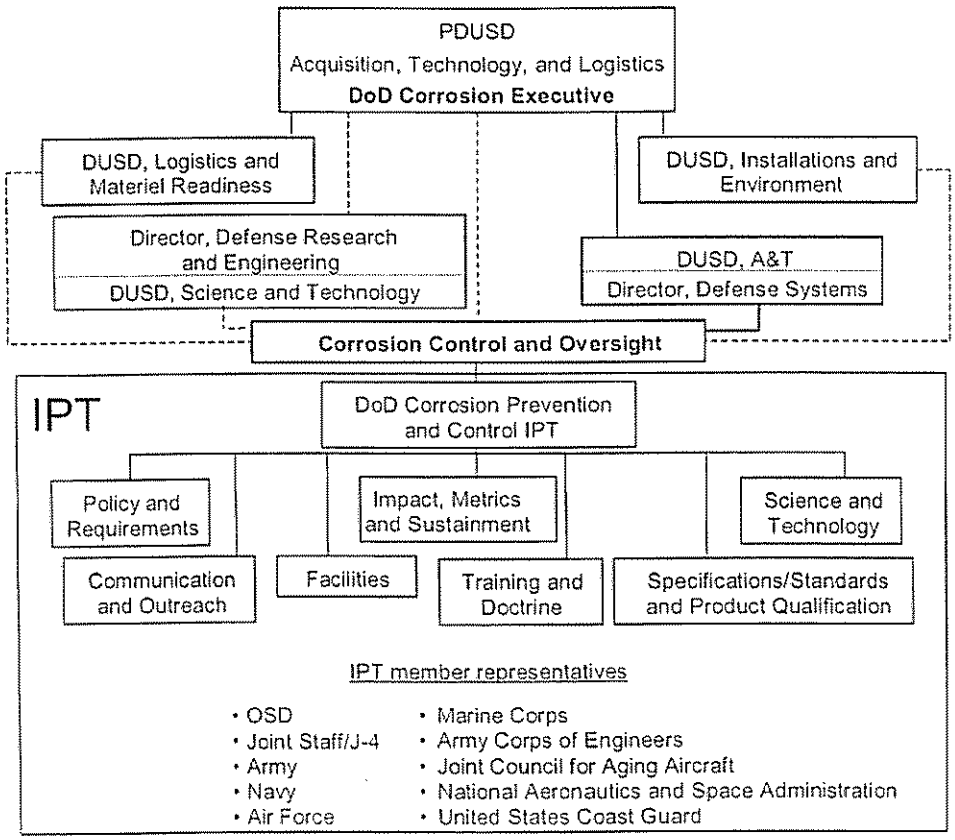
[3] Report to Congress, *Long-Term Strategy to Reduce Corrosion and the Effects of Corrosion on the Military Equipment and Infrastructure of the Department of Defense*, December 2003.

At the heart of the *Strategic Plan* are the specific action items and milestone schedules by each of the seven WIPTs. Highlights of each WIPT's current activities are contained in Section V.

Organizational Structure

Figure I-2 reflects the current structure of the DoD corrosion prevention and mitigation organization. In particular, the recent placement of the Corrosion Control and Oversight responsibilities under the Deputy Under Secretary of Defense, Acquisition and Technology (DUSD[A&T]), is expected to enhance the Department's ability to insert corrosion mitigation products and processes into its acquisition programs. Lines of coordination remain with other key Under Secretary of Defense (AT&L) functions, including DUSD, Logistics and Materiel Readiness; DUSD, Installations and Environment; and Director, Defense Research and Engineering.

Figure I-2. DoD Corrosion Organization



Note: PDUSD = Principal Deputy Under Secretary of Defense.

A central facet of DoD's Corrosion Control and Oversight Program is the Corrosion Prevention and Control (CPC) Integrated Product Team (IPT) depicted in the lower portion of Figure I-2.

The Deputy Secretary of Defense designated the Principal Deputy Under Secretary of Defense for Acquisition, Technology and Logistics (PDUSD[AT&L]) as the responsible corrosion official. The PDUSD provides oversight and coordination for corrosion prevention and control

- during design, acquisition, and maintenance of military equipment;
- during design, construction, and maintenance of infrastructure;
- for monitoring DoD acquisition practices; and
- for ensuring the use and application of corrosion prevention treatments are fully considered during research and development as well as during acquisition engineering and design.

The PDUSD(AT&L) has established a Corrosion Control and Oversight Office—headed by the Special Assistant for Corrosion Control and Oversight in Defense Systems—that is responsible for facilitating the establishment of a viable corrosion prevention control and mitigation program for both equipment and infrastructure in the Department of Defense. The Special Assistant also has the responsibility to lead the Corrosion Prevention and Control Integrated Product Team (CPCIPT).

The CPCIPT is responsible for developing strategic direction, policy, and guidance to prevent and mitigate corrosion of the military equipment and infrastructure of the Department, and was chartered on September 3, 2003. The specific goals of the CPCIPT include

- providing strategic review and advice as necessary to address congressional requirements,
- developing and recommending policy guidance,
- developing a road map and monitoring the progress of corrosion-related activities, and
- developing strategies to efficiently track corrosion costs and their effect on readiness and safety.

As stated, working integrated product teams were established to address the various corrosion focus areas. These WIPTs meet as a group during "Corrosion Forums" (eight have been held to date) and targeted workshops, such as those held recently that focused on training and specifications and standards. Corrosion Forum accomplishments include the

- drafting of policy documents,
- preparation of performance measures,
- development of project submission and approval methods,
- preparation of the *CPC Planning Guidebook*, and
- enhancement of information cross-flow among the functional representatives from the Services and OSD.

In summary, the DoD corrosion prevention and mitigation organization provides the structure and management oversight necessary to fully address both the material (prevent, detect, predict, and manage) and non-material (e.g., training, standards, cost study, and policy) aspects of the program. This integrated approach will continue to target solutions for both material and non-material issues. Specific material-related projects are contained in Section III and non-material-related activities are contained in Sections IV and V.

Summary of Key Activities

The following is a chronology of key DoD corrosion prevention and mitigation activities since the passage of 10 U.S.C Section 2228.

Table I-1. Key Corrosion Prevention and Mitigation Activities

Month	Activity
December 2002	Section 1067 and 10 U.S.C. 2228 requires specific DoD corrosion-related actions, including the submission of this report to Congress
January 2003	Establishment of DoD Corrosion Control and Oversight organization
May 2003	Submission of *Interim Report to Congress*
August 2003	Publication of Corrosion Project Plan template (for assessment of new projects)
September 2003	DoD corrosion website established
October 2003	Corrosion Prevention and Control IPT charter approved
	Established beneficial working relationships with key organizations including NACE International and the Society for Protective Coatings
	CPC input provided to *5000 Final Guidebook*
	CPC input provided to DPG and Programming and Budgeting Activity
November 2003	DoD Corrosion Policy approved and promulgated
	DoD *CPC Planning Guidebook* completed (Spiral 1)
	AMPTIAC special corrosion issue published
	Tri-Service Corrosion Conference conducted
	Inclusion of CPC in the *Designing and Assessing Supportability in DoD Weapon Systems Guidebook*
	DoD Corrosion Executive chartered a Defense Science Board on Corrosion Control
December 2003	*DoD Long-Term Corrosion Strategy* report submitted to Congress
January 2004	Corrosion content added to selected Defense Acquisition University courses
February 2004	CPCIPT Corrosion Training Summit held
	Start of DAU rapid deployment CPC policy/planning training for AT&L work force
	PDUSD(AT&L) corrosion-related video stream inserted into DAU curriculum
March/April 2004	*DoD CPC Status and Update* published in *Defense AT&L* magazine (22,000 distribution)
June 2004	Defense Logistics Agency briefed Corrosion Forum V on their Reliability Engineering Initiative including examples of corrosion mitigation projects
July 2004	*DoD CPC Planning Guidebook* completed (Spiral 2)
September 2004	Requirement to address corrosion in acquisition plans added to the DFARS
	Funding provided for improved reliability of parts managed by DLA
October 2004	Defense Science Board on Corrosion Control published report
November 2004	*Strategic Plan for Corrosion Prevention and Mitigation* published
	Established the position of Special Assistant for Corrosion Control and Oversight
December 2004	Corrosion-related specifications/standards added to Corrosion Exchange website
January 2005	Services commenced approved corrosion projects
	Program commenced cost-of-corrosion study effort
	NACE commenced development of Corrosion 101 course

Section II
Long-Term Funding and Personnel Resources Needed to Implement the Strategy

The term "corrosion" means the deterioration of a material or its properties due to a reaction of that material with its chemical environment.[1]

This section details the resource planning that will enable the Department's corrosion policy and oversight function to successfully meet the milestones in the *Strategic Plan.*

Short Term (FY2005)

During FY2003 and FY2004, program funding came from reallocated OUSD(AT&L) resources. The funding supported program start-up requirements and included a number of specific efforts such as the development of the DoD corrosion planning guidebook; identification and stratification of corrosion related specifications and standards; development of the *Strategic Plan*; identification of acquisition workforce corrosion training requirements; and the creation of project plan templates. In addition, the resourcing supported the preliminary planning of other key objectives such as the cost-of-corrosion study and corrosion training requirements.

The FY2005 budget was the first that employed the PPBE system. For FY2005, $27 million was approved and allocated—$17.5 million for 26 Service corrosion projects, and $9.5 million for CPC activities, including policy implementation (e.g., cost-of-corrosion study, communications [website], and CPCIPT support), corrosion training and certification, specifications and standards assessments, and product qualification process enhancement. Details of the 26 approved projects are contained in Section III. Table II-1 highlights the FY2005 program funding.

Table II-1. FY2005 Corrosion Program and Oversight Funding Summary

Activity	Amount ($)
Technology implementation (project funding)	17.5 million
Policy implementation	7.2 million
Training/certification	1.35 million
Specifications and standards refinement	1.0 million
Total	~$27.0 million

[1] Section 1067 of the Bob Stump National Defense Authorization Act (NDAA) for Fiscal Year 2003, Public Law 107-314, enacted 10 U.S.C. 2228.

Long Term (FY2006–FY2011)

A long-term resourcing approach has been developed and implemented in the Department's Planning, Programming, Budgeting, and Execution process. A funding request totaling about $14.5 million is included in the President's FY2006 budget submission. Table II-2 depicts the source and amount of corrosion program funding through FY2011.

Table II-2. FY2005–FY2011 Corrosion Program and Oversight Funding Summary (in millions)

Requirement	Appropriation	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011
DoD CPC program and oversight management	O&M	–	$9.468	$9.435	$9.435	$9.435	$9.435	$9.435
Army CPC maintenance	O&M	$9	–	–	–	–	–	–
Navy CPC maintenance	O&M	$7	–	–	–	–	–	–
USAF CPC maintenance	O&M	$9	–	–	–	–	–	–
USMC CPC maintenance	O&M	$2	–	–	–	–	–	–
DoD CPC R&D	RDT&E	–	$5	$5	$5	$5	$5	$5
Total		$27	$14.468	$14.435	$14.435	$14.435	$14.435	$14.435

One of the central objectives of the program is to leverage available program resources (personnel and funding) to "germinate" continuing corrosion mitigation progress within OSD and the Services. The following are examples of increased personnel growth, as a direct result of the program's efforts:

- Active and continuing support from over 40 CPCIPT and Corrosion Forum personnel
- Personnel supporting recently approved corrosion projects (e.g., $34 million program and Service-matching funds would support about 230 full-time equivalent personnel[2])
- Support contractors accomplishing specific tasks, including the cost-of-corrosion study, Corrosion 101 course development, identification of maintainer corrosion training and certification requirements; Corrosion Exchange website maintenance; and refining pertinent specifications and standards
- Corrosion Prevention Advisory Team (CPAT) personnel, assigned to support acquisition program requirements
- Defense Systems Assessment Team—approximately 10 people
- Increased numbers of acquisition workforce personnel trained in corrosion awareness by the Defense Acquisition University (DAU).

[2] The DoD Comptroller reimbursable rate for a Navy 0-4 is $148,000 (the annual rate billable to other federal agencies). FY 2005 project funding totals $34 million; that amount, when divided by $148,000, is the equivalent of 230 additional 0-4 personnel supporting corrosion requirements.

Section III
Status of Corrosion Reduction Projects Funded in FY2005

A total of 66 corrosion-related projects were submitted by the Services for approval. Of the submissions, 26 projects were selected based upon established criteria:

- Joint emphasis
- Less than 2 year performance period
- New technology
- Matching/complementary funds
- Return on investment (ROI) based on Office of Management and Budget (OMB) guidelines.[1]

Table III-1 lists the 26 approved projects, and includes the lead Service, whether the project is a joint project, as well as the amount of planned OSD and Service funding.

Table III-1. FY2005 Approved Corrosion Projects and Planned Funding

Project	Joint project	Lead service	Index no.	Service funding	OSD funding
Weapon systems or equipment					
CPC implementation on C-5 aircraft		USAF	AF-W-101	$300,000	$305,000
Aircraft electrical connector corrosion inhibitor implementation	X	USAF	AF-W-107	$114,000	$732,000
Using rapid cure coatings for well deck preservation		Navy	N-W-201	$250,000	$700,000
Wireless corrosion sensor for surface ships		Navy	N-W-203	$400,000	$570,000
Composite electrical boxes	X	Navy	N-W-208	$110,000	$230,000
USMC automated vehicle washdown system	X	USMC	N-W-211	–	$257,000
On the lot dehumidified storage plan		USMC	N-W-212	–	$250,000
Improved coatings for magnesium components	X	Navy	N-W-214	$400,000	$420,000
AvDec sealants for conductive gaskets and floorboard implementation	X	Navy	N-W-215	$3,832,000	$2,910,000
Improved corrosion prevention materials and processes	X	Navy	N-W-216	$220,000	$470,000
Clear water rinse facility	X	Army	AR-W-303	$3,000,000	$2,000,000
AMCOM-NAVAIR corrosion partnership	X	Army	AR-W-305	$400,000	$650,000

[1] Project selection and management information is detailed in *DoD's Corrosion Prevention and Mitigation Strategic Plan*, November 2004, Appendix D.

Table III-1. FY2005 Approved Corrosion Projects and Planned Funding

Project	Joint project	Lead service	Index no.	Service funding	OSD funding
Facilities and infrastructure					
Installation of supervisory control acquisition data automation for cathodic systems	X	USAF	AF-F-116	$468,000	$435,000
Self-prime coating for splash zone steel	X	Navy	N-F-221	–	$750,000
Internal pipeline corrosion inspection Red Hill Tunnel fuel lines	X	Navy	N-F-222	$1,450,000	$1,450,000
Ambient temperature cured coatings (ADSIL)	X	Navy	N-F-223	$300,000	$300,000
Life jacket	X	Navy	N-F-229	$500,000	$500,000
Measuring the rates and effect of corrosion damage on DoD equipment	X	Army	AR-F-311	$427,000	$500,000
Leak detection for pipes	X	Army	AR-F-313	$250,000	$250,000
Non-hazardous corrosion inhibitors/SMART control systems	X	Army	AR-F-314	$1,300,000	$1,300,000
Pipe corrosion sensors	X	Army	AR-F-317	$100,000	$150,000
Ice-free cathodic protection systems for water storage tank	X	Army	AR-F-318	$500,000	$500,000
Corrosion-resistant materials for waste and wastewater treatment	X	Army	AR-F-319	$530,000	$530,000
Surface-tolerant coatings for aircraft hangars, flight control towers, and other assets	X	Army	AR-F-320	$420,000	$320,000
Remote monitoring of cathodic protection systems	X	Army	AR-F-321	$490,000	$490,000
Cathodic protection of hot water storage tanks using ceramics	X	Army	AR-F-322	$1,100,000	$500,000

Twenty-two of the 26 approved projects are designated as joint projects, meaning they are applicable to two or more Services. In addition, other projects are considered synergistic, in that at least one other Service is awaiting the results to determine potential applicability. Joint projects will receive nearly 90 percent of the combined Service and OSD funding.

The ROI for the approved projects, based on OMB guidelines, ranges from 2:1 to 120:1, but the full ROI may not be realized until many years after a project has begun. For example, the composite boxes project (N-W-208) will be installed on nuclear aircraft carriers during their scheduled maintenance availability, so the full ROI will not be realized until all vessels have been enhanced. To manage the investment of resources, the DoD Corrosion Executive established a project analysis cell that reports to the Special Assistant for Corrosion Control and Oversight and tracks the technical and financial status of each project.

The following sections provide additional information on each of the approved weapon systems/equipment and facilities/infrastructure FY2005 projects.

Weapon Systems and Equipment Projects

AF-W-101: Corrosion Prevention Compound Implementation on C-5 Aircraft

Purpose Application of corrosion preventive compounds (CPCs) to C-5 airframes is expected to significantly increase corrosion protection in key areas. The project will adapt existing corrosion prevention and control measures, identify C-5 structural areas that could benefit from CPCs, and apply CPCs with changes to maintenance and inspection requirements.

Technology Existing approved materials using recent technology evaluations for optimization of such materials and their applications.

Application All C-5 aircraft types.

Benefits Avoids structural maintenance down time (thus increasing readiness). Enhances structural integrity and safety. Near-term benefits expected to occur on identified corrosion problem areas on C-5 aircraft.

AF-W-107: Aircraft Electrical Connector Inhibitor Implementation

Purpose Implementation of electrical connector lubricant and CPCs at field level for F-16 aircraft.

Technology Existing materials and applications are approved but not mandated. Numerous studies have proven significant returns on investment.

Application All aircraft avionics and electronics.

Benefits Cannot duplicate (CND) discrepancies and retest OKs (ReTOK) for avionics are reduced many fold, improving mean time between failures (MTBF) rates and readiness. Initially will be applied on F-16 aircraft.

N-W-201: Using Rapid-Cure Coatings for Well Deck Preservation

Purpose Reduce the time needed to preserve amphibious ship well decks by using rapid-cure coatings.

Technology Leverage product development under the Office of Naval Research (ONR)–sponsored single coat program (Future Naval Capabilities–Total Ownership Cost).

Application Rapid-cure solvent-free epoxies and polyurethanes, and their associated application technologies, will be assessed and demonstrated.

Benefits Reduces the time for painting from the current 15-day process to a 2-day process. Surface preparation and setup will be unchanged. OSD and Service funding will yield full-scale product screening and three trial installations.

N-W-203: Wireless Corrosion Sensor for Surface Ships

Purpose Reduce the cost and time spent performing preservation assessment inspections of shipboard tanks and voids.

Technology Wireless corrosion sensors will leverage the current tank monitoring system (instrumented anode with silver–silver chloride [Ag-AgCl] reference cells), including the wireless data logger.

Application The electrochemical tank monitoring system provides continuous condition monitoring. Insertion of wireless capability entirely eliminates need for tank opening for inspections.

Benefits Eliminates opening, gas-freeing, and inspection costs of approximately $15,000 per tank, with approximately 4,000 tanks inspected each year. Current inspection methods are time-driven and do not facilitate pre-availability planning.

N-W-208: Composite Electrical Boxes

Purpose Replace brass electrical boxes that corrode and drive maintenance with corrosion-proof composite.

Technology Leverage composite box technology from Air Force cargo aircraft to deliver cost-effective, corrosion-proof, fire-retardant, shock-qualified, and electromagnetic interference/electromagnetic pulse–(EMI/EMP-) hardened electrical boxes that directly replace current metallic boxes.

Application Replacing metallic boxes with composite boxes has been successful in the fleet via small-scale demonstrations on U.S.S. *Rushmore* (LSD 47) and U.S.S. *Vella Gulf* (CG 72). Development work in approximately 10 sizes per configurations should address shipboard connectors, lights, handsets, and junctions. The goal is to implement a family of composite boxes via large-scale demonstrations on Navy, Military Sealift Command, and Army craft.

Benefits There are approximately 75,000 electrical boxes aboard Navy ships. The use of composite boxes avoids costly re-preservation and replacement of metallic boxes. Three ship sets of electrical boxes are to be installed for demonstration and validation.

N-W-211: USMC Automated Vehicle Washdown System

Purpose Provide a fixed, automated system that will perform efficient and effective cleaning (which is vital to corrosion prevention and control) and be capable of washing 3,600 assets per year at substantial cost and manpower savings.

Technology Leverage an ongoing ONR program that is developing a transportable vehicle washdown system using existing technology developed for industrial truck washes.

Application Throughout the operating forces, where a lack of automated wash-rack facilities requires significant man-hours to be spent conducting maintenance washdowns.

Benefits Will provide a fast and efficient method to perform maintenance washdowns and enhance the corrosion control of assets. Also ensures compliance with environmental laws through wash water treatment. OSD funds will be applied for developing an automated vehicle washdown system for placement at Kaneohe Marine Corp Air Station (MCAS), Hawaii, (III Marine Expeditionary Force [MEF]) where assets are subjected to extreme corrosion conditions.

N-W-212: On-the-Lot Dehumidified Storage Plan

Purpose Develop an administrative storage program (ASP) that will extend the life of Marine Corps tactical ground and ground support equipment and will reduce maintenance requirements and associated costs.

Technology A durable, completely sealed, and portable shelter that provides dehumidified storage of assets to protect them from the harmful effects of corrosion and exposure to wind, rain, moisture, and ultraviolet oxidation.

Application Throughout the operating forces, wherever lack of fixed storage facilities requires equipment maintenance officers to find other means of storing equipment.

Benefits Increase in operational availability of Marine Corps assets and decrease in associated maintenance costs from placing an M1A2 tank in administrative storage. OSD funds will assist III MEF's efforts to purchase 48 storage systems for use at Kaneohe MCAS to collect data and establish an ASP.

N-W-214: Improved Protective Coatings for Magnesium Components

Purpose Reduce corrosion on magnesium alloy components and analyze systems for greatest performance. Corrosion of magnesium components, especially helicopter gearboxes, has always been a problem for aviation platforms. The extremely poor corrosion resistance of magnesium, when coupled with corrosive environments, has led to premature component degradation and replacement. The component cost of replacing these gearboxes for the Navy and Marines H-60 is $291,000 for the main gearbox and $93,000 for the tail gearbox—not including labor.

Technology For touch-up repair and recoating. Coatings include conversion coatings, anodize, primers, topcoats, sealants, and CPCs.

Application Optimized magnesium corrosion protection system. Implementation at Naval Air Systems Command (NAVAIR), Aviation and Missile Command (AMCOM), U.S. Coast Guard, and other users.

Benefits Protective coatings will reduce corrosion, which will reduce replacement costs, maintenance hours, and damage due to removal of current materials, and increase maintenance intervals. Program will provide increased reliability and maintainability and increased readiness of platform.

N-W-215: Av-DEC Sealants for Conductive Gaskets and Floorboard[2]

Purpose Reduce or eliminate corrosion at antenna and floorboard interfaces. Corrosion degradation of antennas, for example, on the Navy's EA-6B Prowler has historically led to the replacement of numerous antennas every year, costing $318,000 in FY2004 alone.

Technology Aviation devices (Av-DEC) gaskets and conductive for antenna applications and non-conductive for floorboards.

Application Applications include

- full implementation of conductive gaskets on all Navy H-60s and EA-6Bs,
- partial (25 percent) implementation of conductive gaskets on Army CH-47 Chinooks and UH-60 Blackhawks being repaired at Corpus Christi Army Depot or RESET facilities, and
- partial (50 percent) implementation of conductive gaskets on Air Force C-130 Hercules being repaired in organic depots.

Benefits Reduces or eliminates corrosion (reduced replacement costs, reduced maintenance hours, increased maintenance intervals, and reduced damage due to removal of current sealants). Also reduces or eliminates communication "gripes" and failures during missions.

[2] Av-DEC®, Aviation Devices and Electrical Components, LLC, is a technical design and manufacturing company that produces non-hazardous polyurethane based products for commercial and military aircraft. Specific areas of focus for corrosion prevention include aircraft-to-antenna mating surfaces, aircraft structural areas, and wire harnesses and interconnects (See http://www.avdec.com/company.htm, accessed 15 December 2004).

N-W-216: Improved Corrosion Prevention Materials and Processes

Purpose Implement better products to prevent corrosion. Also fertilize processes across platforms, facilities, and organizations.

Technology Metalast is an improved process for aluminum anodizing. MIL-L-87177 improved CPCs for avionics and electrical components. Sacrificial repair coating solution where none exists. MIL-PRF-23377 N improved primers for support equipment.

Application This project provides a mechanism to insert corrosion technologies that have been demonstrated and validated through RDT&E support. It uses the information obtained from the fleet to prioritize and assess commercial technologies, performing an analysis of alternatives to down-select to the most promising candidates and conducting operational evaluations of these technologies.

Benefits Better anodize coatings for aluminum (2-times performance gains possible and more efficient processing at depots). Better CPCs for avionics and electrical applications (longer lived, better electrical performance, and reduced maintenance hours and schedule). Fleet touch-up repair for cadmium where none exists. Two-fold performance improvement in SE corrosion resistance possible.

AR-W-303: Clear Water Rinse Facility

Purpose Clear water rinse for helicopters.

Technology Install a clear water rinse system to reduce corrosion and corrosion events.

Application Mitigate corrosion processes and damage to helicopters.

Benefits Improves aircrew safety, reduces maintenance and support costs, and improves readiness. Also, the water used for rinsing is filtered and recycled.

AR-W-305: AMCOM–NAVAIR Corrosion Partnership

Purpose Capture synergism of Army and Navy corrosion reduction efforts for helicopters.

Technology The AMCOM Corrosion Program Office efforts together with the AMCOM-NAVAIR Corrosion Partnership include direct support to the Aviation RESET PMO, performing Army Aviation lead duties for the Joint Council on Aging Aircraft Corrosion Steering Group (JCAA-CSG), and preparation and submission of program requirements for Army aviation and missiles corrosion prevention programs to the Army Materiel Command and the Office of the Secretary Defense. Specific tasks associated with this project include visits to RESET sites to perform corrosion assessments of aircraft, identification of corrosion technology solutions, and conducting corrosion technology training visits for RESET sites worldwide.

Application This single-phase project will continue the joint partnership through the identification and implementation of new corrosion technologies for Army and Navy aircraft. Deliverables will include newly identified corrosion technologies that have a long-term effect for insertion into Army and NAVAIR aviation programs; technical manual and naval aviation training and operating procedures standardization (NATOPS) changes to reflect new corrosion processes or procedures; returning and outbound Southwest Asia helicopter corrosion assessments and analyses; monthly status reports; onsite corrosion training for Army users; and analyses of the costs of corrosion identified during partnership corrosion assessments. The expected result is a reduction in the duplication of efforts and more efficient use of Army and Navy resources.

Benefits Improves aircrew safety, reduces maintenance and support costs, and improves readiness.

Facilities/Infrastructure Projects

AF-F-116: SCADA Monitoring of Cathodic Protection Systems, Robins Air Force Base

Purpose To remotely monitor—through supervisory control and data acquisition (SCADA)—cathodic protection system operation, to ensure they meet Air Force Regulations, NACE standards, and the Code of Federal Regulations.

Technology Uses hardwire and radio unit instrumentation to transmit real time voltage and current readings back to central monitoring.

Application Fuel and water tanks and piping, natural gas lines. Impressed current rectifiers and test stations.

Benefits Provides constant, real time monitoring of corrosion protection systems to meet environmental standards, thus avoiding potential leaks, spills and the resultant fines and cleanup. Enhances maintenance and optimal operation. Serves as a test program to provide techniques of successful design and installation of remote monitoring systems to other military installations.

N-F-221: Self-Priming Cladding for Splash Zone Steel

Purpose Increase service life of the coating of splash zone steel. The "splash zone" is defined as the area between the year's lowest tidal mark and up to ten feet above the year's highest tidal mark. It is extremely difficult to protect steel structures against corrosion in this zone where corrosion rates have been documented to exceed 30 mils per year on unprotected steel.

Technology New Small Business Innovation Research (SBIR) technology employs 40+ mils epoxy novolac/polysulfide.

Application Full scale field installation at Bangor, Washington or Port Hueneme, California. It is a tri-Service effort including accelerated laboratory weathering. Will support either a new DoD standard or an amendment to an existing one.

Benefits Fifty percent increase in service life, shop-applied or field maintenance, and projected savings of $18.7 million per year (816,000 sq. ft.).

N-F-222: Red Hill Pipeline Corrosion Assessment, Fleet Industrial Supply Center (FISC) Pearl Harbor

Purpose Conduct an in-line inspection of a 32-inch diesel pipeline from the Red Hill Storage Facility to Pearl Harbor to determine the extent of corrosion and integrity of the 62-year-old pipeline.

Technology Evaluation of magnetic flux and ultrasonic "smart pigs" (inspection vehicles that move inside a pipe pushed along by the flowing material) for determining fuel pipeline condition.

Application Thirty-two-inch diesel pipeline from the Red Hill Storage Facility to Pearl Harbor, Hawaii.

Benefits Determine the extent of corrosion and integrity of the 62-year-old pipeline to eliminate risk of unexpected failure and resulting environmental costs; allows long-term capital investments planning and scheduling of repairs with minimum impact to mission; increases operability of the pipeline; and increases precision in long-term planning of fuel logistics in the Pacific theater. Also serves as test program to provide techniques of successful pipeline integrity evaluation using "smart pig" technology for other DoD distribution pipeline facilities.

N-F-223: Ambient Temperature Cured Coatings

Purpose Define the functional parameters for application and use to: improve long-term performance; reduce maintenance costs; compile and assess ongoing installation at Jacksonville Naval Air Station (NAS); and provide assistance for planned installation at Pearl Harbor Naval Shipyard (NSY).

Technology Non-traditional, commercially available coatings technology; silicon based coating technology; other non-organic coating systems; and other advanced/non-traditional coating systems.

Application Primary interest: steel structures in aggressive environments. Secondary interest: other substrates and environments to maintain or restore existing coating systems.

Benefits Reduces facility maintenance costs, allows restoration without complete recoat, improves tri-Service specifications, and enhances Society for Protective Coatings (MPI/SSPC) Standards.

N-F-229: Integrated Concrete Pier Piling Repair and Corrosion Protection System

Purpose Install a commercially available, integrated concrete pier piling repair and corrosion protection system on spalled or cracked concrete pier piling.

Technology Integrated concrete repair and cathodic protection (CP) prefabricated in a fiberglass jacket ("lifejacket"). It is commercially available, with an estimated 20-year service life, and easily installed by a contractor.

Application Field installation/demonstration at Pearl Harbor. Installation on 90 of the more than 350 piles being repaired as part of $10 million Commander Naval Region Hawaii (CNRH) pier repair project.

Benefits Restores structures to optimum operational condition, reduces maintenance, and increases service life. Also serves as test program for the "lifejacket" technology.

AR-F-311: Measuring the Rate and Impact of Corrosion Damage on DoD Equipment and Installations

Purpose To develop site-specific corrosion data and model local corrosion impact on various materials.

Technology Integrate corrosion rate measurement at various sites based upon the innovative Battelle corrosion exposure rack system. Also develop criteria for more effective management of corrosion based upon the determined corrosion rates.

Application Corrosion test sites at over 40 DoD, NASA, and Coast Guard locations.

Benefits Optimization of materials selection and corrosion management approaches based upon local environmental conditions. Ensures mission readiness, including critical equipment and facilities. Test program will provide site-specific corrosion rate data and support the development of guidance and standards based upon local corrosion rates for equipment deployment and facility construction.

AR-F-313: Leak Detection for Pipes at Fort Hood

Purpose To implement leak detection technology on the potable water distribution system.

Technology Remotely monitored acoustic sensors detect and record characteristic leak signatures in pipes. DoD-developed signal processing will discriminate leak signals from background noise and determine approximate location of leak. Leak information will be used to target and repair areas of worst corrosion first.

Application Residential section of Fort Hood, Texas.

Benefits Maintains operational and training readiness by supporting deluge requirements, greatly reduces money spent on lost water and reduced manpower needed to locate leaks. Serves as test bed for leak detection technology. Develops guidance and standards for use at other locations.

AR-F-314: Non-Hazardous Corrosion Inhibitors/SMART Control Systems for Heating and Cooling at Fort Carson and Fort Rucker

Purpose To implement an improved approach for controlling corrosion, scale, and microbiological growth in boilers and cooling towers.

Technology Innovative non-hazardous green chemical treatments and a smart monitoring and control system.

Application Two boilers at Fort Carson, seven cooling towers at Fort Rucker, five cooling towers at Fort Hood, four cooling towers at Red River Army Depot, and one cooling tower and one boiler at Brooks Army Hospital.

Benefits Maintains system at optimum treatment levels, reduces failure and downtime, improves safety, minimizes worker contact with treatment chemicals, and ensures heating and cooling for mission critical equipment and training. Serves as test program for non-hazardous chemical treatments and control systems; guidance and standards for use at other locations will be developed.

AR-F-317: Pipe Corrosion Sensors at Fort Bragg

Purpose To implement in-situ sensors that continuously monitor the potable water corrosivity and piping corrosion.

Technology Integrated new generation sensors measure several water quality parameters and assess corrosivity so that water treatment can be tailored to current conditions. In addition, linear polarization resistance sensors will measure actual pipe corrosion rates; problems can be pinpointed and the effectiveness of corrosion control can be monitored.

Application Sensors will be installed at critical locations in the water distribution system (e.g., aircraft deluge systems and fire protection piping for medical facilities).

Benefits Improves water quality, improves safety and reliability of fire suppression systems, and reduces life cycle costs of water distribution systems. Serves as test program for in-situ water corrosivity and pipe corrosion sensors. Guidance and procurement specifications will be developed for use at other locations.

AR-F-318: Ice-Free Cathodic Protection Systems for Water Storage Tanks at Fort Drum

Purpose To implement ice-free cathodic protection (CP) systems to mitigate corrosion inside potable water storage tanks in cold climates.

Technology Innovative CP system is comprised of ceramic-coated wire anodes and a flotation and support system. Ice will no longer destroy CP systems, and the interior of the tank will be continuously protected from corrosion damage.

Application Two elevated water storage tanks at Fort Drum.

Benefits Enhanced safety and reliability for potable water systems; avoidance of unplanned storage tank failures (and resulting loss of fire suppression capability); improved water quality; reduced maintenance costs; and ensures mission readiness, deployment, and training requirements are met. Project also serves as test program for ice-free CP systems. Guidance and procurement specifications will be developed for use at other locations.

AR-F-319: Corrosion Resistant Materials for Water and Wastewater Treatment Plants at Fort Bragg

Purpose Implement advanced materials selection for water and wastewater treatment plants. Fort Bragg has identified severe corrosion problems at both the water treatment plant [WTP] and the wastewater treatment plant [WWTP] due to the harsh environments of sewer gases and chlorine.

Technology Judicious selection of emerging corrosion resistant coatings and alternative materials, and implementation of cathodic protection for tank and machinery components can provide improved corrosion protection. Will include new ceramic anodes for weir and clarifier metallic components, new concrete restoration coatings, UV resistant coatings and gaskets, polyurethane coatings for lampposts, composite doors and stainless steel components.

Application Weir, clarifiers, continuous loop reactor, concrete components.

Benefits Restoration of WWTP to optimum operation condition. Water is critical for operations and deployment. In addition, the WWTP must meet environmental regulations. Corrosion control guidance and standards for WWTP developed for use at other locations.

AR-F-320: Surface Tolerant Coatings for Aircraft Hangars, Flight Control Tower, and Deluge Tanks at Fort Campbell

Purpose To implement surface tolerant coating technology on steel structures.

Technology Overcoat existing deteriorated coatings with minimal surface preparation including moisture cure polyurethane coatings and new fluoropolymer coatings. Applies new self-healing coatings on critical surfaces.

Application One flight tower, two hangars, and two deluge tanks.

Benefits Restores structures to optimum operation condition, reduces maintenance, and increases safety. Serves as test program for surface tolerant coatings/self healing coating technology. Supports development of guidance and standards for use at other locations.

AR-F-321: Remote Monitoring and Cathodic Protection Upgrades at Fort Carson

Purpose Fort Carson is spread over a large area and has many water storage tanks that use special corrosion protection system known as cathodic protection systems, which protect the internal or "water-side" of the tank. The outer surfaces of underground pipes (such as water, gas, or fuel distribution systems) also must be protected from corrosion in the soil using similar CP systems. In either case, CP systems need to be monitored in order to make sure that they are providing enough voltage and current to maintain the cathodic protection.

Technology Upgrade existing CP systems using new ceramic anodes, and new remote monitoring of corrosion potentials, current, etc. Interfaces remote monitoring with SCADA for water tanks and implements drive by systems for other monitor points.

Application Five water reservoirs and pipelines: 30 miles of water distribution, 40 miles of natural gas, 2 miles of fire suppression, and 5 miles of steam line.

Benefits Easier to obtain readings; systems will be better maintained, alerts personnel of problems; increases reliability and safety. Develop guidance and standards for use at other locations.

AR-F-322: Cathodic Protection of Hot Water Storage Tanks Using Ceramic Anodes at Fort Sill

Purpose Implement technology to mitigate hot water storage tanks corrosion.

Technology Impressed current cathodic protection (ICCP) systems using new ceramic anodes. New hot water storage tanks with corrosion-resistant linings and sacrificial anodes.

Application ICCP for 1,000–3,000 gallon HW storage tanks. Linings and sacrificial anodes for 40 gal tanks.

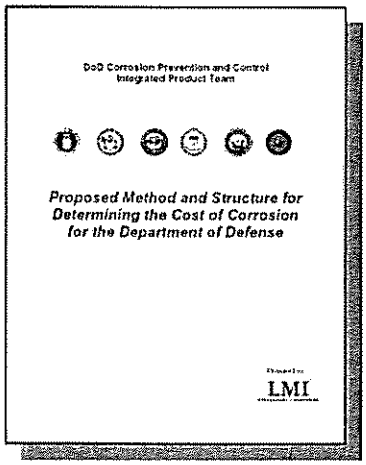
Benefits Extends serviceable life of hot water storage tanks; prevents water damage to electrical and mechanical systems due to leaking tanks. Results will provide guidance documents for other military installations.

Section IV
Status of Cost-of-Corrosion Baseline Study

Determining the cost of corrosion continues to be one of the Department's linchpin requirements. The December 2003 Corrosion Report to Congress stated:

> To quantify improvement—an indispensable metric—an accepted baseline must be established. In addition, reliable corrosion cost estimates are necessary to identify areas that require aggressive action and to justify the expenditure of resources for prevention and mitigation strategy.[1]

DoD remains committed to this goal. An Air Force–funded cost-of-corrosion maintenance study began during FY2004 and is scheduled to be completed in Spring, 2005. In addition, the CPCIPT effort—which uses a DoD-wide methodology—has begun.



The CPCIPT report, *Proposed Method and Structure for Determining the Cost of Corrosion for the Department of Defense,* details the approach being used to estimate the cost of corrosion. According to the report, cost is the most useful information for making decisions.

By determining the usefulness of the information relative to the decisions that would be made with the information, the report determines a priority for acquiring the different types of cost data. The priority ranking is provided in Table IV-1.

Table IV-1. Priority of Acquiring Corrosion Cost Information

Cost element	Priority to acquire
Direct man-hours	1
Materials	1
Scrap and disposal	1
Facilities	2
Test equipment	2
Training	3
Research and development	3
Qualification	3

[1] DoD Report to Congress, *Long-Term Strategy to Reduce Corrosion and the Effects of Corrosion on the Military Equipment and Infrastructure of the Department of Defense*, December 2003, p. III-8.

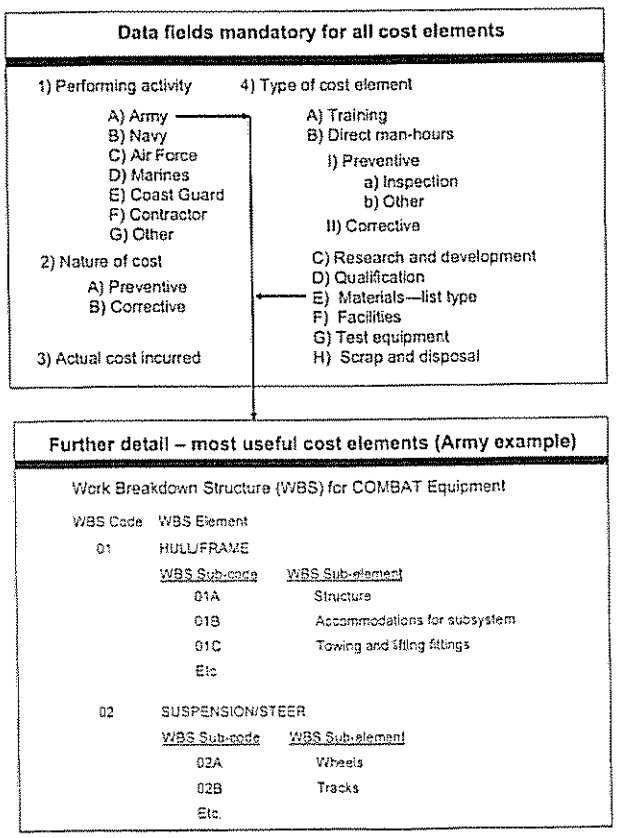
Each of these cost elements is mutually exclusive, and each can be classified as either preventive or corrective.

- *Preventive costs* involve steps taken to remove the causes of potential nonconformities or to make quality improvements. Preventive actions address potential problems, ones that haven't yet occurred.
- *Corrective costs* are incurred if you try to remove the causes of an existing nonconformity or to make quality improvements. Corrective actions address actual problems.

From a management standpoint, it is useful to determine the ratio between preventive costs and corrective costs. Over time, it is usually more expensive to fix a problem than it is to prevent one. But it is also possible to overspend on preventive measures. Classifying the cost elements into preventive and corrective categories helps decision makers find the proper balance between expenses and minimize the overall cost of corrosion.

The CPCIPT report concludes by proposing a standard data structure for capturing the cost of corrosion. The data structure will be configured to provide visibility of corrosion costs at various levels of detail—from Service level to weapon system and sub-system. The same data structure can be used to capture the cost of corrosion for facilities and infrastructure. A field for unique item identifiers will be included in the data structure to allow for analysis of individual items of equipment or facilities. Figure IV-1 outlines the proposed data structure in more detail.

Figure IV-1. Proposed Cost-of-Corrosion Data Structure (Army Example)



Using each Service's existing WBS to associate corrosion costs to as detailed a level as possible allows for better decision making and a focused application of resources to exploit potential improvement opportunities.[2] For example, once the data are complete, the Services will have the opportunity to compare the average corrosion costs by weapon system or by WBS within a weapon system family to determine the highest cost contributors. Examining the ratio of corrective-to-preventive costs by weapon system can isolate potential opportunities to shift this ratio and reduce the overall cost of corrosion for that weapon system. The Services will also have access to the data gathering methodology and the corrosion cost database to support further Service-unique analysis.

Once complete and accurate cost-of-corrosion information is obtained in the cost structure outlined above, it will be useful for making corrosion mitigation decisions. The report highlights different types of decisions that could be made:

- To quantify the overall problem—this helps to determine the level of resources to apply to the corrosion issue both in funding and manpower, and provides a performance metric to assess effectiveness of the overall strategy to reduce the effect of corrosion.
- To prioritize efforts by the highest cost contributors—this helps determine which corrosion sources to attack first.
- To maximize the overall effectiveness of maintenance activities by classifying the costs as either preventive or corrective.
- To determine potential design deficiencies and feed this information back to the acquisition community.

The ability to effectively make these types of decisions rests on the completeness and accuracy of the cost of corrosion information that is available.

To this end, the DoD's Office of Corrosion Control and Oversight, which is supported by the Corrosion Prevention and Control Integrated Product Team (CPCIPT), has planned a schedule of cost of corrosion studies using the standard cost structure outlined in the report. The schedule of cost of corrosion studies is as follows in Table IV-2.

Table IV-2. Schedule of Cost-of-Corrosion Studies

Year	Funding required	Study area
FY2005	$750,000	Data collection and mining of NAVSEA and Army ground vehicles corrosion costs
FY2006	$750,000	Complete NAVSEA and Army ground assessments, accomplish facilities cost study
FY2007	$750,000	Army Air and Marine Corps ground corrosion costs studies
FY2008	$750,000	NAVAIR, Marine Corps Air, and Coast Guard Air corrosion cost studies
FY2009	$750,000	NAVSEA and Coast Guard ships corrosion cost studies
FY2010	$750,000	U.S. Air Force and Army ground corrosion cost studies

[2] The WBS depicted in Figure IV-1 is part of the Army's WBS used in their Operating and Support Management Information System (OSMIS).

The cost study scheduled for FY2005 for Army ground vehicles will focus on combat and tactical vehicles—more than 300 different types of vehicles, with a current inventory of more than 300,000. The cost study scheduled for FY2005 for Navy ships will focus on the "ship battle forces," which include nine different classes of ships (such as submarines, carriers, logistics, and surface combatants). The nine ship classes comprise nearly 300 individual vessels.

The approach and schedule outlined above will enable DoD to establish an accepted cost-of-corrosion baseline. In addition, as soon as reliable corrosion cost estimates are available incrementally, they will be used to identify areas that require aggressive action and to justify the expenditure of resources for prevention and mitigation (just as the results of the Air Force–funded study will mitigate the Air Force's corrosion problems this year).

Section V
Other Updates of Interest

This section highlights the results of the Defense Science Board (DSB) on Corrosion Control as well as recent activities of the CPCIPT working integrated product teams.

Defense Science Board on Corrosion

In order to examine fully the Department's corrosion issues, the DoD Corrosion Executive commissioned a DSB Task Force on Corrosion Control. The DSB Task Force completed its effort in October 2004 and published a report.[1] The DSB made five recommendations:

- Promulgate and enforce policy emphasizing life-cycle costs over acquisition costs in procurement.
- Mandate and implement comprehensive and accurate corrosion data reporting systems across DoD.
- Fund contract for comprehensive assessment of all DoD weapon system equipment.
- Establish corrosion executives for each Service.
- Refocus and reinvigorate corrosion science and technology (S&T) portfolio and increase spending.[2]

In general, the DSB's concerns were in concert with those identified by the CPCIPT. The CPCIPT is actively working on a number of the DSB's recommendations (for example, increasing the acquisition community's emphasis on life cycle costs).

Working Integrated Product Team Updates

The seven components of DoD's long-term corrosion strategy—as represented in the CPCIPT's seven WIPTs—form the foundation of the Department's prevention and mitigation efforts. Although these separate components cover the breadth and depth of corrosion initiatives and enable a compartmentalized focus by the WIPTs, they are interrelated and constitute the cohesive basis for both short- and long-term actions. This section, while attempting not to duplicate the detailed WIPT status contained in the *Strategic Plan*, contains selected recent activities of interest.

There are seven WIPTs:

- Policy and Requirement
- Impact, Metrics, and Sustainment (IM&S)
- Science and Technology
- Specifications, Standards and Product Qualification (SSQP).
- Communications and Outreach
- Facilities
- Training and Doctrine

[1] Defense Science Board, *Report on Corrosion Control*, October 2004. Can be accessed at http://www.acq.osd.mil/dsb/reports/2004-10-Corrosion_Control.pdf.

[2] Defense Science Board, *Report on Corrosion Control*, October 2004, pp. ix, x, and xi.

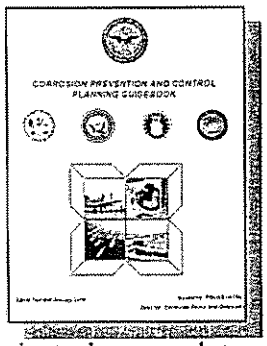
Policy and Requirements

• Policy and Requirements

The most recent accomplishment for the Policy and Requirements WIPT was the inclusion of corrosion requirements in the Defense Federal Acquisition Regulation Supplement (DFARS). The DFARS notice of change adds corrosion prevention and mitigation to the areas that agencies must address in acquisition plans. This change implements section 1067 of the National Defense Authorization Act for Fiscal Year 2003, which requires DoD to prevent and mitigate corrosion during the design, acquisition, and maintenance of military equipment. Specifically, DFARS 207.105(b)(13)(ii) states logistics considerations in the plan of action portion of every acquisition plan will "...discuss corrosion prevention and mitigation plans."

Other earlier accomplishments in the policy area include the following:

- Drafting of the DoD Corrosion Policy Memorandum (Appendix A)
- The implementation of corrosion prevention and control planning as an explicit part of performance-based acquisition as well as performance-based logistics, as defined in DoD Directive 5000.1
- For programs subject to Defense Acquisition Board (DAB) review, an assessment and evaluation of corrosion planning as a standard topic for the Integrating IPT, and the review of corrosion prevention and control planning by the Overarching IPT, with issues raised by exception to the DAB
- Publication of the *Corrosion Prevention and Control Planning Guidebook* (Spiral 2)
- The inclusion of corrosion prevention and control in the *Designing and Assessing Supportability in DoD Weapons Systems Guidebook*
- The implementation of best business practices and best value decisions for corrosion prevention and control in systems and infrastructure acquisition, sustainment, and utilization.



With respect to requirements, the WIPT led the efforts in developing a project plan template to support the prioritization of corrosion-related projects. The template, used to select the projects detailed in Section III include information such as technology, schedule, budget, benefits, return on investment (ROI), operational readiness, supportability, and maintainability information.

Impact, Metrics, and Sustainment

As detailed in Section IV, the recently commenced cost-of-corrosion study is the primary focus of the IM&S WIPT. However, the need for a refined metrics set is also recognized by the CPCIPT.

- Impact, Metrics, and Sustainment

Existing Metrics Set

To effectively monitor corrosion activities at the enterprise level, measurements must allow the assessment of a number of areas, including policy, resources, technology, and communication and outreach.

The IM&S WIPT is addressing the need for metrics and how to estimate the investment necessary to prevent and control corrosion. Although this is a challenging task, the Services have experience determining and analyzing science and technology and acquisition investments.

DoD considers two factors of corrosion measurement.

- The first pertains to the effects of corrosion: What is the cost of corrosion in terms of performance, availability, and resource consumption?
- The second pertains to measuring the payoff from corrosion prevention and control efforts: What is the improvement in performance, availability, and resource consumption?

The IM&S WIPT is addressing both of these factors. The method for measuring the different aspects should be similar and closely associated, because DoD must measure conditions before and after corrosion mitigation actions in order to gauge the extent of improvement. DoD also expects the most revealing metrics (at the macro level) will be related to system availability and total ownership cost.

An initial core set of corrosion-related metrics (depicted in Table V-1) has been developed, approved by the CPCIPT and published in the December 2003 Report to Congress. These baseline metrics allow OSD and Service leaders to assess progress in meeting the agreed-upon corrosion objectives. It was understood that there was flexibility to modify these metrics to meet new or evolving corrosion-related objectives.

Table V-1. Initial Core Set of Corrosion-Related Metrics

Objective	Metric
Short term	
Policy guidance covering all pertinent systems and infrastructure is promulgated and is current and effective.	Narrative assessment. 10 U.S.C. Section 2228(b)(2).
Director, Defense Corrosion Control and Oversight, ensures funding levels remain at or above the FY2006 level (in constant dollars).	Narrative assessment to include budget year funding as percentage of baseline. 10 U.S.C. Section 2228(b)(3).
Monitor compliance with policy that corrosion prevention technologies and treatments are fully coordinated, considered, and incorporated into all major defense acquisition programs and infrastructure projects.	Narrative assessment. 10 U.S.C. Section 2228(b)(4) and (5).
Reviewed and validated information on proven methods and products relating to corrosion prevention of military equipment and infrastructure are available on a central DoD World Wide Web location.	Breadth and currency of information; number of visits to website. 10 U.S.C. Section 2228(c)(2)(C).
Long term	
Achieve returns on investment for Services' projects.	Validate all ROI as soon as projects are implemented.
Reduce corrosion costs.	Each Service will submit corrosion cost reduction status reports for all projects implemented.
Minimize the number of hours of corrosion-related work on military equipment.	Initially a narrative assessment. Will transition to a quantifiable metric if it can be determined that a labor-hour baseline can be established and factors that directly influence corrosion labor hours are identified.
Optimize corrosion prevention and mitigation efforts through training.	Training modules on proper applications and techniques of corrosion compounds, sealants, and coatings are available, are current, and are attended on an annual basis by 100 percent of maintenance personnel charged with corrosion prevention and mitigation.
Maximize safety in the workspace.	Reduce the number of incidents of injury to personnel due to effects of corrosion.

Efforts to Establish a Refined Metrics Set—Balanced Scorecard

The initial set of corrosion policy and oversight metrics are being refined through an iterative process by the CPCIPT. The concept being used mirrors that of a "balanced scorecard" (BSC) and is consistent with the Department's ongoing process measurement efforts that support transformation initiatives, at different enterprise and organizational levels.

In general, performance metrics can be divided into three levels that help determine organizational health: enterprise, functional, or process. The scope of the CPCIPT's effort focuses on the enterprise level of measurement but touches upon the other two levels, because all three levels are linked to provide a complete picture of the corrosion program's health.

Revised Metrics Set Being Reviewed by CPCIPT

As a result of the CPCIPT efforts, a revised set of metrics have been identified and are currently being reviewed for applicability. Those metrics are listed in the following table and includes their perspective (i.e., cost, readiness, safety, or WIPT-related); metric title; and metric description. The key cost-of-corrosion metric was previously discussed in Section IV.

It is important to emphasize that the metrics process is iterative and is continually under review for improvement. For example, during Corrosion Forum VII, it was determined to add a Metrics tab to the Corrosion Exchange website. Initial information will include the existing set of short-term and long-term metrics as well as registered "hits" on the website. Additional data to be posted in the near term includes corrosion-related Service safety statistics and information pertaining to the currency of corrosion-related specifications and standards.

Table V-2. Potential Revised Metrics Set

Perspective	Title	Description
Cost	Direct labor hours	Corrective and preventive corrosion labor hours
	Materials	Corrective and preventive corrosion cost and rate
	Scrap and disposal	Rates by type of equipment
	Corrosion-related facilities and support equipment	Preventive, hours spent for the purpose of corrosion mitigation, e.g., wash facility
	Corrosion-related test equipment	Preventive, hours spent checking for corrosion
	Corrosion project ROI	Implementation cost savings
	Life cycle costs	Equipment cost reductions due to corrosion initiatives
Readiness	Failure rates versus time	MC–FMC rate comparison before and after corrosion projects
	Unit level corrosion events	Corrosion work-order events over time
	Facility level corrosion events	Corrosion work-order events over time
	Field level workload events	Corrosion work-order events over time at field level
	Depot level workload events	Corrosion workload events over time at depot level
Safety	Personnel injury	Events over time related to corrosion
	Mishaps (corrosion-related)	Events over time related to corrosion
	Facility incidents	Events over time related to corrosion
WIPTs	Policy and Requirements	Percentage of policy goals accomplished
	Impact, Metrics, and Sustainment	Percentage of IM&S goals accomplished
	Science and Technology	Quantify material remaining life and technical predictions
	Facilities and Infrastructure	Percentage of base surveys accomplished
	Communication	• Website visits per month • Conferences or meetings addressed by CP&O
	Training	Percentage of training plans and personnel trained versus goals
	SSQP	Percentage of specifications and standards reviewed and updated

As highlighted earlier, the critical CPCIPT metric is the cost of corrosion, and this will remain the primary focus of the IM&S WIPT.

Science and Technology

The Science and Technology (S&T) WIPT was established to ensure a continuous interchange and liaison with DoD corrosion research personnel and programs. It augments—but does not duplicate—the broad-based DoD strategic planning activity known as Defense Reliance. DoD corrosion S&T projects and plans remain included within the Joint Warfighting Science and Technology Plan, the Defense Technology Area Plan, the Basic Research Plan, and associated, appropriate defense technology objectives.

- Science and Technology

In order to integrate S&T within the CPCIPT and establish a bridge to S&T managers and planners, the S&T WIPT developed a roadmap of actions and functions specific to the CPC area. Details of the specific actions taken, progress made, and status are included in the Department's *Strategic Plan*. Recent accomplishments are presented below.

Metal-Nonmetallic Composite Interactions (e.g., aluminum-bismaleimide [Al-BMI] corrosion)

Common themes have been discussed within the S&T WIPT. These themes are being used to establish a higher fidelity planning/reporting taxonomy for Service and Agency corrosion projects in order to make comparisons and contrasts among projects clearer and more efficient.

Advanced Surface Treatments and Coatings for Non-Traditional Uses of Materials

Similar to the accomplishment above, common themes have also been discussed within the S&T WIPT. These themes are being used to establish a higher fidelity planning/reporting taxonomy for Service and Agency corrosion projects in order to make comparisons and contrasts among projects clearer and more efficient. This theme will be further developed and highlighted in the Materials and Processes Technology Area Review and Assessment in 2005.

Service-Specific Technologies and Programs

The program summaries contained in the strategic plan provide a first iteration, noting where applicable the Service emphasis and specific needs addressed. Additional specific Service focus and themes can be found in the Materials Science chapter of the DoD Basic Research Plan.

Review, Assessment, Comparison, and Proposal of R&D Programs and Projects

This is a fundamental and ongoing mission of the S&T WIPT.

Multidisciplinary University Research Initiative Topics

The S&T WIPT has identified several significant topics for Multidisciplinary University Research Initiative (MURI) consideration. The MURI selection process is competitive; therefore, the status of these proposals is not known. Because MURI is an ongoing program, this

is expected to be an area of regular attention by the WIPT. The next major round of MURI topic selection will be through the second quarter of FY 2005.

Small Business Innovation Research Topics

Approximately 40 topics were drafted to address themes identified by the CPCIPT and the S&T WIPT. These topics were evaluated for the Office of the Secretary of Defense (Pentagon) SBIR initiative that began to accept proposals in early July 2004. Following a review of these topics and an assessment of the available Small Business Innovation Research (SBIR) budget, 17 topics were chosen for solicitation in the OSD04 solicitation. These topics are in addition to the 6 corrosion-specific topics provided within the Service SBIR programs within the solicitation.

SBIR Initiative Phase I

Two to three Phase I awards in each of the corrosion topics are expected in early FY2005.

SBIR Initiative Phase II

Following completion of Phase I contract performance, successful and promising concepts will be invited to submit Phase II proposals. In general, at least one Phase II award per topic can be expected. Phase II contracts have execution periods of up to two years. Many promising SBIR concepts and research products are then supported by non-SBIR funds in a Phase III development effort supported by DoD or commercial ventures. Often SBIR products graduate directly to military or commercial sales for the small business.

Maturation Program Prospectus

Often S&T results and products are insufficiently mature or unproven to be inserted directly into Defense or commercial systems, processes, or products. The S&T WIPT has established an ongoing effort to identify promising candidates for further maturation or demonstration and to publicize the value and opportunity presented by these corrosion materials, processes, etc. This is an ongoing task with major milestones associated with FY2006 and FY2007 fiscal planning.

Communications and Outreach

One of DoD's major corrosion prevention and mitigation goals pertains to the collection and dissemination of corrosion data and information. The Communication and Outreach WIPT therefore works with the various Service organizations and industry, standards organizations, and professional societies to improve the Department's data collection and dissemination policies and procedures.

• Communications and Outreach

The Communications and Outreach WIPT continues to achieve noteworthy progress toward meeting many of its objectives. The WIPT has

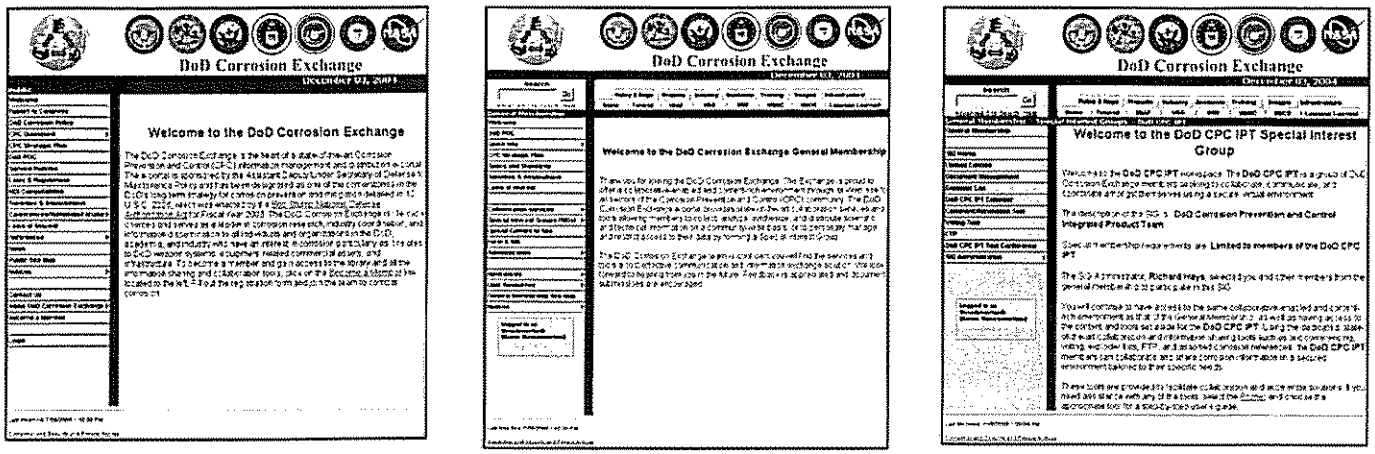
- developed the DoD Corrosion Exchange website, www.DoDCorrosionExchange.org;
- enhanced the biennial Tri-Service Corrosion Conference—the overall goal of the 2005 conference is *Transcending and Integrating Corrosion Prevention Control for the Department of Defense*;
- established a relationship with the NACE International—The Corrosion Society, with SSPC, the Society for Protective Coatings, and will continue to develop other relationships as needed;
- forged a working relationship with the Advanced Materials and Processes Technology Information Analysis Center, and published a special issue of the AMPTIAC Quarterly, outlining DoD corrosion policy, program, and requirements; and
- identified "corrosion ambassadors" to participate in pertinent forums.

This update focuses on the progress on developing and implementing a broad and accessible web-based knowledge foundation. The initial and most important task of the WIPT was to establish the DoD Corrosion Exchange website.

The website enables the WIPT to achieve numerous objectives, including supporting and improving communication, collaboration, and coordination within the corrosion community; increasing the effectiveness of corrosion prevention and control research and operations; identification and dissemination of lessons learned; developing, maintaining, and expanding the web-based information aggregation and sharing capabilities of the website; and maintaining a content-rich, collaboratively enabled online environment for all members.

Figure V-1 depicts three of the DoD Corrosion Exchange's web pages—the initial Welcome page is accessible to the public, the Member page and the Special Interest Group (SIG) page is accessible to members of designated SIGs (e.g., the specifications/standards SIG and the cost-of-corrosion SIG).

Figure V-1. Website Screens—Public Page, Member Page, and SIG Page



Membership of the DoD Corrosion Exchange totals approximately 670, with about 270 members from DoD and government, 304 from industry, 80 from research, and 15 from other areas. Since January 2004, membership has increased 130 percent.

The average number of website sessions during 2004 was about 2,200 per month, and the most downloaded document is the December 2003 *Corrosion Report to Congress* (downloaded nearly 19,000 times) followed by the *CPC Planning Guidebook* (downloaded more than 11,000 times). The total number of website "hits" since its inception exceeds 2.7 million.

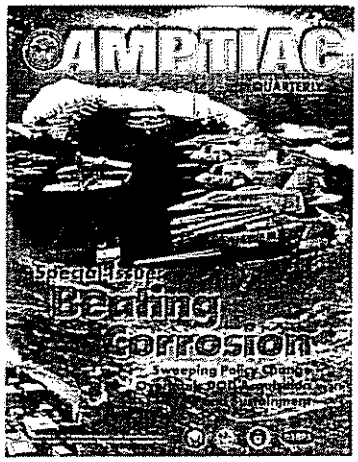
By any measure, the DoD Corrosion Exchange has been a tremendous success. Its usefulness will continue to increase as new capability and information is added, such as the specifications and standards matrix, which is outlined later in this report.

In addition to the success of the DoD Corrosion Exchange, other communications and outreach activities, in particular AMPTIAC and NACE International, continue to enhance the effectiveness of the Department's corrosion mitigating efforts.

The Defense Technical Information Center (DTIC) sponsors the Advanced Materials and Processes Technology Information Analysis Center (AMPTIAC), which was established under competitive contract in 1996 and receives management and technical oversight by OSD(DDR&E).

AMPTIAC is operated for DoD by Alion Science and Technology and provides a wide range of corrosion-related functions, including inquiry services, newsletter, data gathering and analysis, and product development (state-of-the-art reviews, technology assessments, and databases).

AMPTIAC published the DoD a special corrosion issue,[3] which promoted the mission of Corrosion Control and Oversight Office and



- introduced the new DoD corrosion policy;
- introduced the new Corrosion Control and Oversight Office;
- highlighted achievements and ongoing corrosion management activities of the Services;
- raised awareness of corrosion resources (new and established); and
- advocated the importance of corrosion management to policy makers.

This 84-page issue continues to be a "must-read" for private sector as well as public sector corrosion personnel.

Finally, two important corrosion-related organizations are supporting the CPCIPT's efforts. NACE International—The Corrosion Society is a professional technical society that offers technical training and certification programs, sponsors conferences, and produces industry standards and reports, publications, and software. With more than 15,000 members, NACE advances the knowledge of corrosion engineering and science.

SSPC—the Society for Protective Coatings (formerly the Steel Structures Painting Council) is a professional technical society/trade organization that offers technical training and certification programs, sponsors conferences, and produces industry standards and reports, publications, and software. With more than 8,000 members, SSPC advances the knowledge of coatings from surface preparation to selection, application, and the engineering and science of coatings.

Both NACE and SSPC are important resources in addressing corrosion prevention and control issues. Their ability and willingness to leverage private sector corrosion expertise provides the CPCIPT with unique and significant benefits.

[3] The AMPTIAC Quarterly, Volume 7, Number 4, Winter 2003.

Facilities

The Tri-Services Facilities CPC WIPT continues to enhance its ability to address inter-service efforts in policy development; acquisition, design, and construction; criteria development; technology demonstration, validation, and implementation; and technical training. The WIPT's efforts are improving the Department's ability to prevent and mitigate facilities corrosion.

• Facilities

The following information updates facilities corrosion prevention initiatives that implement methods and technologies to protect facilities and infrastructure from corrosion, and outlines the necessary steps to achieve this objective.

The program is being implemented in five phases: implementation of innovative CPC technologies for DoD facilities; review of all technical guidance; review of sustainment policy and cost factors; identification of unique facility issues; and identification of new R&D requirements. Specific steps to implement the facilities corrosion prevention program include the following:

- Issue DoD facility corrosion prevention policy.
- Ensure design and construction criteria and maintenance requirements are current and incorporate the latest corrosion prevention technology.
- Review sustainment strategy and cost factors to ensure all corrosion prevention requirements and costs are included. Update where necessary.
- Implement new, innovative CPC technologies starting in FY2005.
- Prioritize facilities or structures where corrosion can result in catastrophic failures or significantly impact safety, health, or the environment. Assign corrosion protection priorities to facility categories of infrastructure.
- Identify required research, testing, and evaluation.
- Develop, revise, and update criteria resulting from OSD and Service CPC program funded projects.
- Conduct CPC base surveys.

The Facilities WIPT is the advocate for facilities issues for all DoD CPC initiatives. DoD facilities provide the foundation for mission-essential tasks such as deployment, training, and providing a secure and environmentally safe base of operations and accommodations for personnel. WIPT members attend or provide input to other product teams to ensure facilities issues are included and addressed in each initiative. The following are some of those activities in support of the other six WIPTS:

- Policy and Requirements—provided a listing of all known facility policy and criteria documents; provide input to the numerous documents including the strategic plan, the

CPC planning guidebook and the CPC policy memorandum; and identified 25 FY2005 CPC projects

- Impact, Metrics, and Sustainment—provided preliminary facilities cost of corrosion information; allocated resources for development of metrics to determine the facilities cost of corrosion facilities; and initiated the first joint equipment and facilities project to determine the rates of corrosion at over 40 facility locations
- Science and Technology—awarded six OSD-sponsored SBIR Phase I projects for development of new innovative CPC technologies and worked with the S&T and R&D communities to identify possible strategic technical objectives for CPC; and supported the development of an action plan to include R&D requirements in the Joint Warfighter S&T plan
- Communications and Outreach—provided facilities input towards the development of the infrastructure portion of the DoD Corrosion Exchange Website; arranges for DOD CPC presentation briefings for key Service facilities leaders; and identifies know facilities websites that address corrosion
- Training and Doctrine—inserted key facilities training requirements into the overall DoD Corrosion 101 training outline; identified FY 2005 training requirements for facilities personnel; and coordinated facilities presentations at the most recent DoD Tri-Service Corrosion Conference
- Specifications/Standards and Product Qualification—revised protective coatings, industrial water treatment, and Cathodic protection design manuals; provided facilities input into the overall CPC specifications and standards matrix (detailed in the SSQP section); and provided input for enhancing the product qualification process.

The Tri-Services Facilities Corrosion Control Network has identified additional potential corrosion projects in support of the long-term mitigation strategy, including

- corrosion surveys;
- non-corroding materials selection;
- upgrade of cathodic protection systems;
- high-performance coatings;
- high-performance, non-hazardous corrosion inhibitors;
- centers of expertise; and
- training.

The Services currently have programs and guidance in place, and continue their efforts to identify the funding and resources (e.g., trained manpower) to implement the initiatives.

Each of the projects is important, but the centers of expertise are particularly critical because they play a critical role in implementing the Facilities Corrosion Control Program (specifically in the development and updating of corrosion-related criteria). Therefore, the centers will develop and update pertinent documents.

Training and Doctrine

The overall training and doctrine long-term strategy objective is to identify and properly train every individual—DoD and contractor—whose actions could measurably prevent or mitigate the Department's equipment and infrastructure corrosion. DoD's corrosion training plan therefore focuses on both the acquisition and sustainment workforces.

• Training and Doctrine

With respect to the acquisition workforce, a series of three corrosion courses are anticipated—Corrosion 101, Corrosion 201, and Corrosion 301. The courses will consist of an escalating level of comprehension from awareness to comprehension, and finally application. Table V-3 depicts the composition of the planned Corrosion 101, 201, and 301 courses, including the training subjects and the five groups of anticipated students: program managers, acquisition logisticians, systems engineers, facility engineers, and contracting personnel. Further, NACE International has started developing the Corrosion 101 course.

Table V-3. Planned Composition of Corrosion 101, 201, and 301 Courses

Training Subjects	Program Managers			Acquisition Logisticians			Systems Engineers**			Facility Engineers***			Contracting Personnel		
	Awareness	Comprehension	Application	Awareness	Comprehension	Application	Awareness	Comprehension	Application	Awareness	Comprehension	Application	Awareness	Comprehension	Application
Program Related Corrosion Issues															
Mr. Wynne streaming video presentation	X			X			X			X			X		
NACE-provided corrosion orientation film	X			X			X			X			X		
CPC-IPT-developed corrosion plan (briefing)	X			X			X			X			X		
Program requirements (e.g., laws, regulations, policies)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Corrosion program development	X	X	X	X	X	X	X	X	X	X	X		X	X	X
DOD contractual process for incorporating corrosion requirements	X	X		X	X		X	X		X	X		X	X	X
Environmental and regulatory considerations	X	X		X	X		X	X		X	X		X	X	
Design Related Corrosion Issues															
Basic corrosion theory	X			X			X	X		X	X		X	X	
Design criteria and materials selection	X	X		X	X		X	X		X	X	X	X	X	
Critical corrosion design and materials tradeoffs	X			X			X	X		X	X	X	X		
Corrosion testing and characterization of materials.	X			X			X	X		X			X		
Analysis and correction of corrosion failures.	X			X			X	X		X	X		X		
Affects of environment on corrosion	X			X			X	X		X	X		X		
Materials and processes during manufacturing and repair	X			X			X	X		X			X		
Coatings, sealants, adhesives, finishes, inhibitors, etc., and their impact	X			X			X	X		X	X		X		
Deterioration and compatibility of non-metallic and metallic composite materials	X			X			X	X		X	X	X	X		
New technology structural and corrosion control materials for future systems	X			X			X	X		X	X	X	X		
Cathodic Protection principles and application										X	X		X		
Industrial water treatment principles and application										X	X				
Selection of Industrial and Architectural coatings for facilities										X	X	X			
Sustainment Related Corrosion Issues															
Readiness, safety, and cost impacts of corrosion	X	X		X	X		X	X		X	X		X		
Maintenance practices and procedures	X	X		X	X		X	X		X	X	X	X		

* Corrosion 101 will only cover training subjects at the awareness level. Additional detail would be in subsequent course(s), e.g., Corrosion 201, 301, ...
** Refers to systems engineers who are not corrosion specialists. Corrosion systems engineers will require training at the Application level.
*** Refers to facilities engineers who are not corrosion specialists (e.g. planning, design and Public Works management engineers - but not necessarily the base corrosion engineer. Corrosion facilities engineers will require training at the Application level.

The Defense Acquisition University (DAU) recently revised its lesson plans to include initial corrosion-related training for systems engineers, contract specialists, and program managers. In addition to providing basic knowledge regarding corrosion and its effects, the training focuses on awareness and policy for program managers and preventive technology for engineers.

Once equipment is fielded or facilities are completed, they are subject to corrosion resulting from a wide-range of variables including age, usage, and the environment. While the highest return on investment normally occurs during the acquisition design process, it is essential that most maintenance and other selected personnel be adequately trained in corrosion identification, prevention and remediation. A recently completed corrosion training white paper also addresses the following sustainment-related approach:

- Identify DoD personnel (officers, enlisted, and civilians) that require corrosion training.
- Define scope of required training.
- Identify potential training shortfalls for the workforce at all levels.
- Identify potential shortfalls in continuous training/certification.
- Recommend the updating of training requirements (e.g., course development, training materials, trainers, and training sites) to include implementation of emerging technologies.

Specifications, Standards and Product Qualification

Part of the strategy to mitigate the overall effects of corrosion is to make it easier for private sector companies to participate in the process, specifically to make it simpler to qualify effective new products for DoD and related agency use. From DoD's perspective, a standard process is needed to make the corrosion mitigation needs visible to industry while quickly weeding out those proposed products that are not effective in fighting corrosion, or do not have a sufficient return on investment to warrant further testing and use.

To help accomplish both of these objectives, the SSQP WIPT has started to develop two key management tools. The first is a specification and standard matrix, a listing of pertinent existing DoD approved specifications and standards that are related to corrosion. The second is a standardized qualification process for bringing corrosion related products to potential testing and use within DoD.

Specification and Standard Matrix

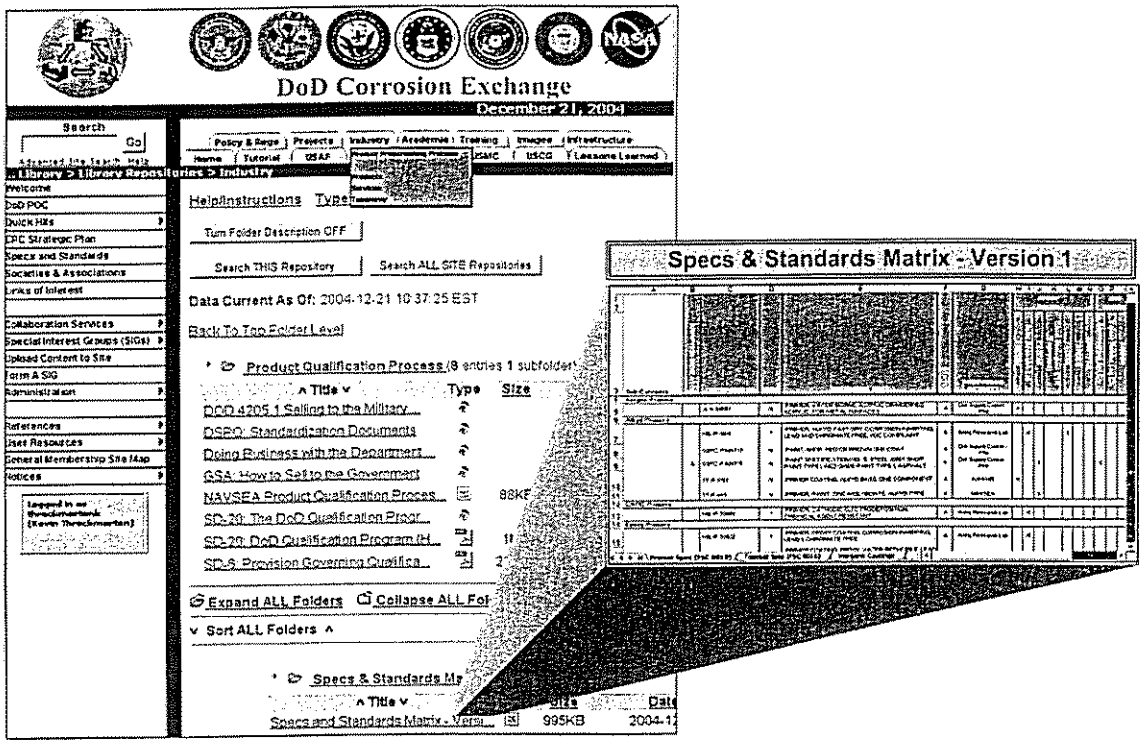
The SSQP WIPT developed a composite listing of corrosion related specifications and standards through solicitations from each DoD and non-DoD user, and by investigating the Acquisition Streamlining and Standardization Information System (ASSIST) database, a central document repository. Lists of specifications from the two sources were compiled, redundancies eliminated, and the documents classified by category. A total of approximately 1,300 documents were sorted into categories and sub-categories to facilitate product requirements identification.

Further value-added information was documented about each specification such as the preparing activity, users of the specification, and its current status. A lookup tab of all specifications sorted in alphanumeric order was included as the last tab of the spreadsheet. This specification and standards matrix was placed on the DoD Corrosion exchange website[4] in December 2004 as part of the single point of entry concept for prospective vendors. A link will be established from each specification in the matrix to its corresponding document identification number in the ASSIST database, facilitating both electronic and hardcopy retrieval.

The specification and standards matrix contained on the DoD Corrosion exchange website is depicted in Figure V-2.

[4] See www.dodcorrosionexchange.org/private/Specs_and_Standards/maindisp.cfm.

Figure V-2. Specification and Standards Matrix



Qualification Process

The second key tool being developed by the SSQP WITP is a standardized product introduction and qualification process. The process is being developed in three phases, with the SSQP WIPT continually updating and improving the products developed in each phase.

- Phase 1: *Provide a single point of entry into the process for current and prospective DoD and related agency vendors*. This will be the DoD Corrosion Exchange website. This website contains useful information for a vendor to research how to sell a product to the government. The following is among the information contained on this website:
  - The first version of the specifications and standards matrix
  - SD-6: "Provisions Governing Qualification"
  - SD-20: "The DOD Qualification Program (How To Use It), Qualified Products List (QPL) And Qualified Manufacturers List (QML)"
  - A guide on "Doing Business with the Department of Defense"
  - The General Services Administration (GSA) online guide "How to Sell to the Government"
  - The GSA paint, sealant, and adhesive schedule information
  - A guide on "Selling to the Military."

- Phase 2: *Provide a visual aid to describe the process for selling a new product that can be qualified under an existing specification.*
- Phase 3: *Provide a visual aid to describe the process for selling either a new product, or a new application for an existing product, for which there is not a current specification that is applicable.*

Phase 1 is complete and a draft process has been developed for Phase 2 and Phase 3. Once the process for Phase 2 has been completed, it will be displayed on the DoD Corrosion Exchange website and implemented. Phase 3 will be implemented thereafter.

Appendixes

Appendix A
Policy Memorandum

THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

NOV 12 2003

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS

SUBJECT: Corrosion Prevention and Control

The Department of Defense (DoD) acquires, operates, and maintains a vast array of physical assets, ranging from vehicles, aircraft, ships, and other materiel to wharves, buildings, and other stationary structures that are subject to corrosion. Consequently, corrosion control contributes significantly to the total cost of system ownership. To control these costs, I believe we need to revitalize our approach to tracking, costing, and preventing or controlling corrosion of systems and structures. Specifically, we need to concentrate on implementing best practices and best value decisions for corrosion prevention and control in systems and infrastructure acquisition, sustainment, and utilization.

Basic systems design, materials and processes selection, and intrinsic corrosion-prevention strategies establish the corrosion susceptibility of Defense materiel. The early stages of acquisition provide our best opportunity to make effective trade-offs among the many competing design criteria that will provide desired Defense capability. I believe that corrosion needs to be objectively evaluated as part of program design and development activities and the inevitable trade-offs made through an open and transparent assessment of alternatives. Therefore, I want this requirement to be specifically addressed during the earliest phases of the acquisition process and by decision authorities at every level. I will personally consider this issue for programs subject to Defense Acquisition Board (DAB) Review.

I have directed that a review and evaluation of corrosion planning be a standard topic for the Integrating Integrated Product Team reviews and that the Corrosion Prevention and Control Planning be reviewed by the Overarching Integrated Product Team with issues raised by exception to the DAB. To assist all of us in designing effective strategies, corrosion prevention and control planning guidance will be included in the "Designing and Assessing Supportability in DoD Weapons Systems" guidebook. We are also drafting a "Corrosion Prevention and Control Planning Guidebook," which will provide assistance in general corrosion-control planning and the implementation of sound materials selection and treatments during the design, development, and sustainment of DoD weapons systems and infrastructure.

Thank you for your support as we develop a long-term DoD corrosion prevention and control strategy. My focal point for this effort is Mr. Daniel Dunmire, Director, Corrosion Policy and Oversight, at 703-681-3464, e-mail daniel.dunmire@osd.mil.

Michael W. Wynne
Acting

Appendix B
Compliance Matrices

House Report 108-553—DoD Appropriations Bill, 2005 (Corrosion Control)

Reporting Requirement	Report Pages
The collection and analysis of data on corrosion costs, readiness implications and safety data	IV-1, IV-2, IV-3, IV-4, V-5
The development and promulgation of clearly defined, outcome-oriented objectives and performance measures	V-3, V-4, V-5
The level of resources required and budgeted to accomplish the objectives	II-1, II-2, III-1, III-2
The oversight mechanism that coordinates and oversees corrosion prevention and mitigation efforts among the defense agencies and military services	I-3, I-4, I-5

Government Accountability Office Audit GAO-04-640

Reporting Requirement	Report Pages
Long-term funding and personnel resources needed to implement the corrosion strategy	II-1, II-2, I-4, I-5, III-2
Status of the corrosion reduction projects funded in fiscal year 2005	III-1 to III-16
Status of the cost of corrosion baseline study	IV-1, IV-2, IV-3, IV-4

Appendix C
Abbreviations

AAF	Army Air Field
AAIPT	Aging Aircraft Integrated Product Team
ADSIL	Ambient Temperature Cured Coatings
AF	Air Force
AFRL	Air Force Research Laboratory
Ag-AgCl	silver-silver chloride (reference electrode)
Al-BMI	aluminum bismaleimide
ALC	Air Logistics Center
AMCOM	Aviation and Missile Command (U.S. Army)
AMPTIAC	Advanced Materials and Processes Technology Information Analysis Center
AR	Army Regulation
ASP	Administrative Storage Program
ASSIST	Acquisition Streamlining and Standardization Information System
AT&L	Acquisition, Technology and Logistics
Av-DEC®	Aviation Devices (and Electrical Components)
BDE	Brigade
CARC	Chemical Agent Resistant Coating (paint)
CFFT	Corrosion Fleet Focus Team
CG	Guided Missile Cruiser
CMO	Corrosion Management Office
CND	cannot duplicate

CNRH	Commander Naval Region Hawaii
COE	Corps of Engineers
CP	cathodic prevention (or protection)
CPAT	Corrosion Prevention Advisory Team
CPC	Corrosion Prevention and Control
CPCs	Corrosion Preventive Compounds
CPCIPT	Corrosion Prevention and Control Integrated Product Team
CSG	Corrosion Staging Group
DAB	Defense Acquisition Board
DAU	Defense Acquisition University
DDRE	Director Defense Research and Engineering
DFARS	Defense Federal Acquisition Regulation Supplement
DOC	Department of Commerce
DOE	Department of Energy
DOT	Department of Transportation
DPG	Defense Planning Guidance
DROLS	Defense RDT&E On-Line System
DTIC	Defense Technical Information Center
DTL	Detail specification (as in MIL-DTL)
DUSD	Deputy Under Secretary of Defense
ECD	estimated completion date
EMI/EMP	Electromagnetic Interference/Electromagnetic Pulse
ESTCP	Environmental Security Technology Certification Program
FY	fiscal year

FYDP	Future Years Defense Program
GAO	Government Accountability Office
GSA	General Services Administration
HAP	Hazardous Air Pollutant
HDBK	Handbook
HMMWV	High Mobility Multi-purpose Wheeled Vehicle
ICCP	Impressed Current Cathodic Protection
IPT	Integrated Product Team
IRAC	interim rapid action change
IVHM	Integrated Vehicle Health Monitoring
JACG	Joint Aeronautical Commanders Group
JCAA	Joint Council on Aging Aircraft
JTP	Joint Test Protocol
LSD	Landing Ship Dock
M&P	materials and processes
MAUS	Mobile Automated Scanner
MCAS	Marine Corps Air Station
MEF	Marine Expeditionary Force
MIL	Military Specification, e.g., MIL-DTL (detail specification) and MIL-PRF (performance based specification)
MTBF	Mean Time Between Failures
MURI	Multidisciplinary University Research Initiative
NACE	National Association of Corrosion Engineers
NAS	Naval Air Station

NASA	National Aeronautics and Space Administration
NATOPS	Naval Aviation Training and Operating Procedures Standardization
NAVAIR	Naval Air Systems Command
NDAA	National Defense Authorization Act
NDE	nondestructive evaluation
NDT	nondestructive test; nondestructive testing
NSY	Naval Shipyard
O&M	Operations and Maintenance
OMB	Office of Management and Budget
ONR	Office of Naval Research
OSD	Office of the Secretary of Defense
OUSD	Office of the Under Secretary of Defense
PBD	Program Budget Decision
PDUSD	Principal Deputy Under Secretary of Defense
POL	petroleum, oil, and lubricants
PPBE	planning, programming, budgeting, and execution
PRCRP	Pacific Rim Corrosion Research Program
PTO	Pacific Theater of Operations
QML	Qualified Manufacturers List
QPL	Qualified Products List
R&D	research and development
RDT&E	research, development, test, and evaluation
Re-TOK	Re-test OK
ROI	return on investment

S&T	science and technology
SBIR	Small Business Innovation Research
SCADA	Supervisory Control And Data Acquisition
SERDP	Strategic Environmental Research and Development Program
SOAR	Special Operations Aviation Regiment (U.S. Army)
SSPC	Society for Protective Coatings (formerly Steel Structures Painting Council)
SSQP	specifications, standards, and qualification process
UFC	unified facilities criteria
UHM	University of Hawaii, Manoa
USCG	United States Coast Guard
VOC	volatile organic compound
WIPT	working integrated product team